

Inexpensive In-situ Predictive Performance Tool for SCR Catalyst in the Power Plant Environment

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Summary

The reduction of NO_x through the use of SCR remains one of the foremost methods used today. Unfortunately, although any number of tests and installations reported in papers, conferences and technical dissertations, along with computer and physical modeling, have been devoted to this very important environmental and economic problem, the fact remains that, to a great extent, the choice of proper catalyst, substrate, location, orientation, and composition, is very site specific, and the academic considerations are, unfortunately, only a guess at what will actually occur in a real operating environment. It is to eliminate or, in the least, alleviate this inexactness that the CoPilot™ module is directed. In the past, attempts to provide similar testing included very expensive slip stream arrangements, with limited ability to exactly replicate actual in-duct conditions, or conditions at differing locations, or meaningful accelerated effects of passage of time. The reliability and cost advantages of a novel test module developed by HERA, LLC are clearly demonstrated when compared with existing techniques for predictive monitoring of catalyst performance and longevity.

The CoPilot™ test module is a small, inexpensive, self-contained device which, when inserted in the flue gas, precisely emulates the environment in which the catalyst is expected to operate. Injection of ammonia inside the module makes it possible to gather catalyst performance data on-line. The module can be inserted into the flue gas duct and withdrawn without any interruption to the power plant operation.

By means of the CoPilot™ module, which includes a simple compact testing section, which is adapted to use real or anticipated primary duct conditions, and inserted in such ducts in a manner to gather information on a variety of relevant factors and operating conditions (i.e. temperature, pressure drop, catalyst efficiency, ammonia slip, blockage, degradation, catalyst poisoning, and the like), at different locations, and without requiring boiler downtime, the above mentioned prediction and failures problems are overcome or, in the least, greatly alleviated. Furthermore, the CoPilot™ permits running side by side tests, in one or several locations within the primary exhaust gas stream. Also, the test module provides means for assuring that the in-duct tests will indeed replicate expanded ducts, higher and/or lower velocity conditions, by independently controlling the flue gas flow through the module,

and insuring steady state conditions at the selected level.

As an additional feature of the CoPilot™ module, it is useful in determining the desirability of whether or not to add a layer of SCR catalyst to a previous control scheme which employed selective non-catalytic reduction (SNCR), or even in addition to existing banks of SCR.

The following bullet points reiterate and expand the distinct advantages discussed above:

- # Performance Improvement - the actual operational testing afforded by the CoPilot™ will aid in verifying and optimizing efficiency vis a vis effect of flue gas and fly ash compositions, effect of distribution (flow, temperature, ammonia, NO_x), simultaneous activity under real conditions of a number of factors such as location, sizing and type of substrate, variable loading cycling, and the like.
- # Life Expectancy - the testing procedure of the CoPilot™ will readily identify potential seriousness, and/or timing of catalyst masking, catalyst poisoning, catalyst erosion, effect of water/vapor, problems with trace elements, cleanability, effect of additives, ambient problems (i.e. salt in the air), results of attempts of optimization of other portions of the plant, and the like.
- # Balance of Plant Impact - the resultant data gained by CoPilot™ will assist in developing economic schemes to alleviate pluggage, ammonia slip from SCR and/or SNCR, with or without SCR, the ability to use and the effectiveness of ammonia destruction catalyst, air preheater pluggage effects, predictions on the ability to market the ash, and the like.
- # Modeling - Modeling results will become much more reliable, nomographs may be developed in certain circumstances, particulate projectory patterns will be simpler to model and estimate, math assumptions can be validated to a much greater degree of accuracy , and the like.

These and other features and advantages of the CoPilot™ module are addressed in the balance of the paper.